

## ABSTRACT

The present invention provides a process of separating a sample including forming magnetic microspheres including magnetic particles, the magnetic microspheres adapted for attachment to a receptor agent, sorting the magnetic microspheres by passage through a magnetic separator so as to separate the magnetic microspheres into a number of distinct populations of magnetic microspheres, each distinct population with a specific range of magnetic moments, attaching a different receptor agent to each distinct population of magnetic microspheres with a specific range of magnetic moments, combining a target sample with the number of distinct populations of magnetic microspheres containing the different attached receptor agents together for a period of time sufficient to allow for binding between attached receptor agents and target species within the target sample to form one or more receptor agent-target species complexes, and, re-sorting the distinct populations of magnetic microspheres containing the different receptor agent-target species complexes by passage through a magnetic separator. The present invention also provides a process of analyzing a sample including forming magnetic microspheres including magnetic particles, the magnetic microspheres adapted for attachment to a receptor agent, sorting the magnetic microspheres by passage through a magnetic separator so as to separate the magnetic microspheres into a number of distinct populations of magnetic microspheres, each distinct population with a specific range of magnetic moments, attaching a different receptor agent to each distinct population of magnetic microspheres with a specific range of magnetic moments, combining a target sample with the number of distinct populations of magnetic microspheres containing the different attached receptor agents for a period of time sufficient to allow for binding between attached receptor agents and target species within the target sample to form one or more receptor agent-target species complexes, individually passing the magnetic microspheres in a fluid microsphere suspension into a flow channel and past a magnetic measurement system capable of measuring the magnetic moment of each individual magnetic microsphere so as to identify to which distinct population each suspended magnetic microsphere belongs, and, analyzing individual magnetic microspheres in a detection system for detectable properties of receptor agent-target species complexes so as to measure a detectable property of **each** receptor agent-target species complex. The present invention also provides a process of

collecting a sample including forming magnetic microspheres including magnetic particles, the magnetic microspheres adapted for attachment to a receptor agent, sorting the magnetic microspheres by passage through a magnetic separator so as to separate the magnetic microspheres into a number of distinct populations of magnetic microspheres, each distinct population with a specific range of magnetic moments, attaching a different receptor agent to each distinct population of magnetic microspheres with a specific range of magnetic moments, combining a target sample with the number of distinct populations of magnetic microspheres containing the different attached receptor agents for a period of time sufficient to allow for binding between attached receptor agents and a target species within the target sample to form one or more receptor agent-target species complexes, individually passing the magnetic microspheres in a fluid microsphere suspension into a flow channel and past a magnetic measurement system capable of measuring the magnetic moment of each individual magnetic microsphere so as to identify to which distinct population each suspended magnetic microsphere belongs, and, collecting individual magnetic microspheres of at least one distinct population of magnetic microspheres. The present invention also provides a process of detecting multiple analytes in a sample including exposing a pooled population of subsets of magnetic microspheres to a sample, the magnetic microspheres in each subset having (i) a magnetic characteristic classification parameter that distinguishes the magnetic microspheres of one subset from those of another subset according to a predetermined magnetic measurement and (ii) a reactant specific for an analyte of interest, passing the exposed pooled population of subsets of magnetic microspheres through an examination zone, and, determining the identity and quantity of each analyte of interest in the sample by substantially contemporaneously (i) collecting data relating to the magnetic characteristic classification parameter, (ii) collecting data relating to the presence or absence of a complex formed between the reactant and an analyte of interest specific to the reactant, (iii) classifying each magnetic microsphere to its subset according to its predetermined magnetic measurement, and (iv) quantifying the amount of complex associated with each subset.